Prevalence and Characteristics of Road Traffic Injuries Among Young Drivers in Oman, 2009-2011

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ABSTRACT

Objectives

Studies from different parts of the world have indicated that the impact of road traffic incidents disproportionally affects young adults. Few known studies have been forthcoming from Arabian Gulf countries. Within Oman, a high proportion of the population is under the age of 20. Coupled with the drastic increase of motorization in recent years there is a need to understand the state of road safety among young people in Oman. The current research aimed to explore the prevalence and characteristics of road traffic injuries among young drivers aged 17-25 years.

Methods

Crash data from 2009-2011 was extracted from the Directorate General of Traffic, Royal Oman Police (ROP) database in Oman. The data was analyzed to explore the impact of road crashes on young people (17-25 years), the characteristics of young driver crashes and how these differ from older drivers and to identify key predictors of fatalities in young driver crashes.

Results

Overall, young people were over-represented in injuries and fatalities within the sample time period. While it is true that many young people in crashes were driving at the time, it was also evident that young people were often a victim in a crash caused by someone else. Thus, to reduce the impact of road crashes on young people, there is a need to generally address road safety within Oman. When young drivers were involved in crashes they were predominantly male. The types of crashes these drivers have can be broadly attributed to risk taking and inexperience. Speeding and night time driving were the key risk factors for fatalities.

Conclusion: The results highlight the need to address young driver safety in Oman. From these findings, the introduction of a graduated driver licensing system with night time driving restrictions could significantly improve young driver safety.

Keywords

Traffic, Crash, Young, Driving, Oman, Middle East

INTRODUCTION

In recent years, Oman has experienced significant social changes and increased standard of living, being credited by the United Nations Development Program as the most-improved nation (United Nations Development Programme, Regional Bureau for Arab States 2009). Recent affluence in Oman has triggered an increase in motorization rates, leading to an increased burden of road traffic fatalities and injuries (Al-Reesi et al. 2013; Islam and Al Hadhrami 2012). As such, Oman has one of the highest road traffic mortality rates in the world, estimated at 30.4 per 100,000 people (World Health Organization 2013), far exceeding the global average of 19 deaths per 100,000 population (Al-Maniri et al. 2013; Al-Reesi et al. 2013; Royal Oman Police 2011). Road traffic incidents are the second leading cause of death among adults aged 15 to 44 years (Dahl 2004) and the leading cause of deaths among those aged 15 to 29 years (World Health Organization 2011). Oman has in a demographic profile characterized by a 'youth bulge' (Al-Sinawi et al. 2012), with 44.7% of population under the age of 20 (National Center for Statistics and Information 2013). In future years, greater numbers of young Omanis will begin to drive and thus, it is important to examine the prevalence and characteristics of road traffic injuries among young drivers in Oman.

Al-Maniri et al. (2013) found that males aged 16-25 years have the highest magnitude of road crashes in Oman, constituting 38.7 to 59.7 deaths per 100,000 population. However, little research has examined factors that contribute to these incidents in Oman. Jaffer et al. (2006) reported that among a sample of nationally representative secondary school students (N=3,345) around one-third (33.0%) had driven at least once without the appropriate license and 34.0% reported that they liked to speed while driving. Al Reesi et al. (2013) examined responses to the

Driving Behavior Questionnaire among young drivers in Oman and found that speeding and aggressive violations were common. Similar findings have been revealed in research conducted in neighboring GCC countries. These studies have shown aggressive driving, speeding, seatbelt non-use and the use of cell phones as main contributory factors in crashes among young drivers (Al-Hemoud et al. 2010; Bendak 2005; Bener et al. 2008; Hamadeh and Ali 2013).

In the broader international literature, a significant amount of research has examined risk factors which characterize the crash profile of young drivers. Many of these factors have been attributed to a lack of driving experience, the age of young drivers and the impact this has on their psychology and neurophysiology, as well as the interaction between these two factors. Newly licensed drivers are seen to be inexperienced and are seen to engage in higher levels of risk taking (Williams 2006; Williamson 2003). Compared to older drivers, young drivers are over-represented in crashes (Whelan et al. 2009). Young drivers are more likely to experience at-fault, single-vehicle, weekend, night-time, speeding and abnormal weather-related crashes (Ferguson and Braitman 2006; Ferguson et al. 2007; MacDonald et al. 1994; Whelan et al. 2009; Williamson 2003). Further, when a single-vehicle crash or night-time crash occurs, there is increased severity (Whelan et al. 2009). In addition, young male drivers are at a greater risk of crash involvement compared to young female drivers (Laapotti 2003; Laapotti and Keskinen 2004; Simons-Morton et al. 2006).

One factor to consider, which is somewhat unique to Oman, is the nationality of drivers. Expatriates in Oman account for 44% of the total population (National Center for Statistics and Information 2014). It is anticipated that expatriate drivers are less common in the younger age group, since the majority of expatriates are among the older age groups. Expatriate drivers were

account for 35% of road fatalities in Oman during 2013, and also 22% of non-fatal injuries of the same year (Royal Oman Police 2013). Given the large expatriate population of Oman, it is possible that expatriate young drivers play a significant role in road safety. If this is the case, there may be cultural differences which present difficulties to addressing road safety. It is thus important to determine the extent to which expatriate drivers are present within young driver crashes.

A variety of age ranges are used to identify young drivers. The minimum age in any given young driver range is commonly defined according to licensing restrictions in the relevant jurisdiction, and typically extends to a maximum age of 25 years. Within Oman, the minimum age to apply for a driver license is 18 years, however, in limited situations the traffic authorities are permitted to issue a license for those aged 17 years (Royal Oman Police 1993). Therefore, for the purpose of the current research, young drivers in Oman are categorized as drivers aged between 17 and 25 years inclusive. The purpose of the current study is to examine (1) the impact of crashes on young people aged 17-25 in Oman, (2) the characteristics of young driver crashes, (3) how young driver caused crashes differ from those caused by others drivers, and (4) predictors of fatalities within young driver crashes.

METHODS

Crash Data

The data employed in the current study was extracted from the Directorate General of Traffic, Royal Oman Police (ROP) database in Oman. Crash data was sourced for three years from 1 January 2009 to 31 December 2011. Due to the need to understand not only the nature but also relative prevalence of young driver road crashes, all road crashes in this period were examined.

This crash data set contains information regarding the occurrence of the crash (day, time, road type, weather condition, reason for the crash as determined by police investigation and the severity of the crash) the individuals involved (age, gender, nationality, mode of involvement and severity of injury). With regards to injury severity, fatality is recorded where an individual involved in a crash dies by the time of file closure in January of the next year, while injury includes any harm requiring medical attention. The data that is contained in this database is drawn from police investigations. The crashes investigated include all major crashes as defined under ROP policy. In 2006 the ROP instated a policy under which major crashes (public property damage, injury or an inability for involved drivers to peaceably determine who was at-fault) are investigated, and all other crashes can be settled between the involved drivers and their insurance companies (Al-Maniri et al. 2013; Al-Reesi et al. 2013). Due to the manner in which data is collected, the data is predominantly concerned with the at-fault vehicle and driver and labeling crash causes.

In addition to the data being limited to serious crashes, it should be noted that there is an absence of a formal rigorous investigation processes in the ROP and the investigation only reports a single crash cause. Some subjective factors (such as the precise cause of a crash) may be open to error. There were relatively few instances of some crash causing behaviors, which may either reflect low incidence or low reporting. As such, for the purpose of the current analysis it was decided to focus primarily on objective driver (age, gender, nationality, mode of involvement in crash) and crash (no. of vehicles involved, time of day, day of week, road types, crash types and injury and crash severity) characteristics. In the case of crash causes, speed can be considered easier to detect, due to long skid marks, and severity of vehicle damage. For this reason, it was

decided to still analyze where crashes were caused by speed, along with those deemed to be caused by external factors or a combination of other driver behaviors (combined due to low reporting). Whilst this aspect of the data analysis may be more prone to error it was decided that it was important to understand the outcomes associated with speed in the data. Additionally, as there is only a single cause of crash recorded, this represents the primary causal behavior of the at-fault driver in the crash. Thus, the analysis will primarily focus on the at-fault driver, as any behaviors or crash details listed for not at-fault drivers are actually representative of a crash caused by another individual.

The data was received in three linked datasets (access file contains three tables: crash, person and vehicle), which were combined to run the analysis. Therefore, a specific query in the Access file was made to combine the required data from the three datasets and to identify the at fault vehicles and thus at fault drivers. The data was then exported, eliminating error from transcription, into Statistical Package for Social Sciences (SPSS version 21.0) for the required statistical analysis.

Analysis

Bivariate and multivariate analyses were conducted to address the key research questions. Chi-Square tests of independence were used to assess the relationship between the collected variables and involvement in crashes, being the at fault driver and crash severity. Effect size was calculated with the phi coefficient (for 2*2 tables) and Cramer's V. A multiple logistic regression model was used to investigate possible predictors of young drivers' crash severity (fatal vs non-fatal crashes). Wald test was used to assess the significance of the relationship

between independent variables and crash severity and odds ratios were calculated to measure the strength of the association. All tests used a 0.05 level of significance.

RESULTS

The Impact of Road Crashes on Young Driver-Aged People in Oman

The retrieved data included summary statistics for all people involved in crashes in the time period. As such, it was possible to examine how the involvement of individuals in crashes differed for those aged 17-25 (for which specific data was given) compared to all others (aged <17 or >25) involved in crashes. A total of 51,865 people were involved in road traffic crashes in Oman over the time period examined, of whom 2,829 were killed and 31,313 were injured. Of all people involved in a crash, 17,318 (33.4%) were aged between 17 and 25 years. Of these young people, 10,801 sustained survivable injuries and 795 were killed.

Table 1 displays the distributions of gender, nationality and injury severity for individuals in all crashes in Oman alongside those for young people aged 17-25 and the remainder of all people involved in crashes in the time period (those aged <17 and >25 years). There was no statistically significant difference between the proportions of males and females in each group, with males accounting for 80.7% of those involved in crashes. Whilst 20.2% of the total people involved in crashes were non-Omani, the proportion of non-Omani people involved in crashes did differ by age group ($\chi 2$ (1) = 2660.551, $p < 0.01$), with only 7.3% of those aged 17-25 involved in crashes being non-Omani. In terms of the mode of involvement in crashes, neither group were more likely to be drivers, who accounted for 64% of the total sample, however, young people aged 17-25 were less likely to be pedestrians and more likely to be passengers or pillion passengers, $\chi 2$ (2) = 509.908, $p < 0.01$. Regarding injury severity, the proportions of injuries were also

significantly different between age groups ($\chi 2$ (2) = 62.436, $p < 0.01$), with younger people more likely to be non-fatally injured, and less likely to experience no harm or be fatally injured.

Young vs. Older Driver Crashes

Of those young driver-aged people involved in crashes 11,101 were driving at the time of the crash. Due to the manner in which the ROP collect data, and the emphasis on at-fault drivers, further analyzing the factors present within the crashes of all young drivers would result in findings which are partially influenced by crashes caused by other drivers. As such, the remaining analysis focuses on at-fault young drivers. A total of 7,727 young drivers (69.6%) were deemed at fault by the ROP at the time of the investigation, of whom 89.6% were male and 94.7% were of Omani nationality. Young driver crashes were fairly consistently spread throughout the day, however, only 11.1% occurred during the early morning. Most crashes occurred on weekdays (69.5%), under normal weather conditions (97.2%) and on single carriageway roads (70.7%). Collisions with other vehicles (43.3%) and motorcycles or bicycles (3.7%) accounted for close to half of the crashes, with the remainder consisting of various single vehicle crash types. Speeding was the most common reason for crashes (53.4%). The majority of young drivers who were at fault in crashes suffered no injury (50.8%). However, 67.9% of young driver crashes resulted in some form of injury to the driver or another person involved in the crash.

In the absence of population data for prevalence of each of the analyzed factors, it is difficult to ascertain the impact of these factors on the likelihood of crashes occurring. Nonetheless, it is possible to compare young at fault drivers to older at fault drivers to determine how the crash profile of at fault young drivers differs to older drivers. Table two presents the frequency of each

factor in crashes caused by younger and older drivers. There was no statistically significant relationship between gender, day of the week or weather and the age of the driver responsible for the crash (young or old). When compared to older drivers, young drivers were more likely to be Omani nationality ($\chi 2$ (1) = 1220.9, $p < 0.01$, phi=0.24). They were more likely to crash at night and less likely to crash in the morning ($\chi 2$ (3) = 23.31, $p < 0.01$, V=0.03). Young drivers were more likely to crash on single carriageway roads ($\chi 2$ (1) = 13.705, $p < 0.01$, phi=0.03), as well as more likely to crash with a fixed object, though less likely to be in a run over type crash ($\chi 2$ (4) = 44.228, $p < 0.01$, V=0.05). Young drivers were more likely than older drivers to crash due to speeding, though less likely to crash due to other behaviors ($\chi 2$ (2) = 28.116, $p < 0.01$, V=0.04). With regards to injuries suffered by the driver, young drivers were more likely to suffer non-fatal injuries and less likely to experience no harm ($\chi 2$ (2) = 22.32, $p < 0.01$, V=0.03). However, in terms of the overall severity of crashes, the only statistically significant difference between younger and older drivers was a decreased likelihood of no harms crashes among young drivers ($\chi 2$ (2) = 8.966, $p < 0.01$, V=0.02).

Fatal Crashes Among Young Drivers

In order to further understand the most severe crashes among young Omani drivers, analyses were conducted to examine the role of various factors in predicting whether a fatality resulted from crashes in which a young driver was at-fault. For the purpose of this analysis, all young driver at-fault crashes were included, and crash severity was converted to a binomial categorical variable indicating either a fatal crash or non-fatal crash (both no harm and non-fatal injury crashes). Of the 798 fatal crashes in which young drivers were at fault 94.9% were caused by male drivers, and 94.4% by Omani nationals. These crashes were most common at night (39.5%)

though there was a fairly even spread across the remaining time periods. These crashes typically occurred on weekdays (64.8%), in normal weather conditions (95.9%) and on single carriageway roads (67.2%).Vehicle collisions (34.7%) were the most common crash type, followed by over-turn (26.3%) and run-over (24.1%). Speeding accounted for more than half of these crashes (62.3%).

Bivariate analyses were conducted to determine factors associated with the likelihood of a fatality occurring and are presented in table three. Only nationality was not associated with the likelihood of a fatality. Fatal crashes were more likely to occur when a crash was caused by a male driver ($\chi 2$ (1) = 26.181, $p < 0.01$, phi=0.06). Crashes were more likely to result in a fatality when occurring at night or in the early morning ($\chi 2$ (3) = 38.207, $p < 0.01$, V=0.07), on weekends ($\chi 2$ (1) = 9.472, $p < 0.01$, phi=0.04), in abnormal weather conditions ($\chi 2$ (1) = 6.311, $p < 0.05$, phi=0.01) and on dual carriageways ($\chi 2$ (1) = 5.442, $p < 0.05$, phi=0.02). Crashes involving a run-over, overturn or collision with a motorcycle or bicycle were more likely to result in a fatality ($\chi 2$ (4) = 280.498, $p < 0.01$, V=0.19), as were those caused by speeding or non-human factors ($\chi 2$ (2) = 47.961, $p < 0.01$, V=0.08).

Significant bivariate predictors were included in a multiple logistic regression to account for the influence of covariates. The results of this logistic regression are presented in table four. A Hosmer-Lemeshow test (test = 6.117; *P* value = 0.634) indicated a good level of fit, and the model explained 10.2% of the variance in likelihood of a fatality when a crash occurred (Nagelkerke's $R^2 = 0.102$). To calculate odds ratios for the predictors, the majority of referent groups were selected based on the most numerous categories (day, weather, road type, crash type, crash reason). However, in the case of gender, it was decided to use females as a referent

category, as it is common for the relative risk of male drivers to be expressed as an increase in risk relative to females. Finally, for the time of day, the morning category was selected as a referent group such as to examine how risk increases throughout the day. Crash severity was significantly predicted by all predictors except weather condition. Crashes with male drivers were 1.97 times as likely as those with females drivers to result in a fatality (P <0.01). While there was no significant difference between morning and evening crashes, crashes at night and in the early morning were, respectively, 1.37 ($p < 0.01$) and 1.76 ($p < 0.01$) times more likely than morning crashes to result in fatality. Crashes which occurred on weekends were 1.21 times more likely to result in fatality than those on weekdays ($p < 0.01$), and crashes occurring on dual-carriageways were 1.43 times more likely to result in a fatality than those on single-carriageways ($p < 0.01$). Compared to vehicle collisions, run-over crashes (OR=2.38, P <0.01), over-turn crashes (OR=1.41, P <0.01) and motorcycle/bicycle crashes (OR=1.82, P <0.01) were at increased likelihood of fatalities. However, fixed object collisions were close to a third as likely to lead to a fatality (OR=0.29, p<0.01). Compared to crashes caused by speed, other type of risky behaviors were less likely to cause fatal crashes (OR=0.58, P <0.01) while crashes caused by non-human factors were more likely (OR=1.41, P<0.05).

DISCUSSION

The Impact of Road Crashes on Young People Aged 17-25

The first aim of this study was to establish the impact of road crashes on young people aged 17-25 in Oman. Approximately one third (33.4%) of people involved in crashes were part of the target demographic. Further, this age bracket accounted for 28.1% of road crash fatalities and 34.5% of injuries. Young people were less likely to be unharmed or killed, but at a higher risk of

non-fatal injuries. It is estimated that young people aged 15-24 account for between 26.3% (National Center for Statistics and Information 2011a) and 20.2% of the population (Central Intelligence Agency 2013). Neither of these estimates use the same age range as the current study, however, young people do appear to be disproportionally affected by road crashes. This is congruent with other international reports (Lozano et al. 2012)

Close to two thirds of the young people in these crashes were driving at the time. Given 69.6% of these were deemed by the ROP to be at-fault and 35.9% of young people were passengers or pedestrians, over half of young people in crashes were victims, rather than responsible for the incident. As such, there is a need to improve overall road safety in Oman to reduce the impact on young persons.

Characteristics of Young Driver Crashes

The second and third aims of the study were to examine the characteristics of young driver crashes and compare these to those of older drivers. In order to avoid confounding the results, this analysis was conducted with at-fault drivers only. Key characteristics of young driver crashes included a high proportion of males and Omani drivers, crashes predominantly occurring on single-carriageway roads, and being mainly caused by speeding. The remaining characteristics seemed somewhat representative the nature of the data source (only major crashes) or showed no unexpected pattern of results (e.g. weekend and week day crashes were proportional to the number of days).

The finding that males had higher involvement in crashes is consistent with a recent review of international young driver research (Bates et al. 2014). In some Arab Gulf countries, female driver are somewhat ‘frowned’ upon (Al-Ahmadi et al. 2006), however, in recent years

significant attention has been given to the empowerment of women in Oman (Varghese 2011). Over the past 15 years, the proportion of females receiving licences in Oman has increased by more than 50%, reaching 24% of new licenses in 2010 (Royal Oman Police 2011). As 89.6% of young at-fault drivers in the present sample were male, it appears that males are over represented in crash involvement, though investigation of exposure is required.

Despite the established view that young male drivers are more likely to engage in risky driving (Rhodes and Pivik 2011) and seek the 'thrill of speed' (Fuller et al. 2008; Richards et al. 2010; Yannis et al. 2007), when comparing older and younger drivers there was no significant differences in gender. However, the recent increase in female licensing may be masking the expected relationship between age and gender in at-fault crashes.

Given that expatriates account for 44% of the total population of Oman (National Center for Statistics and Information 2014), it was important to examine expatriate representation in young driver crashes. In the current data, Omanis represented the vast majority of all drivers in crashes, and particularly more so for young drivers. Thus any cultural barriers to improving young driver safety are only a minor concern.

To reduce the problem of road traffic crashes among young drivers it is important to understand the causes behind these crashes. There are many studies showing human error to be among the greatest causes of young driver crashes (Braitman et al. 2008). Young drivers are more likely to be involved in speeding and other simultaneous unsafe practices, as well as hooning behavior (Bates et al. 2014). In the current study young drivers had an increased likelihood of crashes due to speed, a high proportion of speed related incidents, a high incidence of overturns and fixed object collisions, as well as an increased likelihood of crashing on single carriageway roads. This

indicates a pattern that young driver crashes result from speeding and inexperience of controlling vehicles. Single carriageway roads present opportunity for crashes from departing the roadway in either direction, having either a fixed object or overturn crash (on the outer edge of the road) or colliding with another vehicle (by entering oncoming traffic). This interpretation is consistent with the literature pertaining to human error and honing, but is also consistent with general views that young drivers crash partially from risk-taking behavior as well as inexperience (Williams 2006; Williamson 2003).

Predictors of Fatality in Young Driver Crashes

The final aim of the study was to examine the predictors of fatalities in young driver crashes. There was little difference in the factors most prevalent for fatal crashes and overall young driver crashes. However, there were significant differences for a number of factors indicating an increased likelihood of fatalities. The strongest predictors of fatality in the logistic regression analysis were run-over type crashes, being male, crashes with motorcycles and bicycles, and early morning crashes. Crashes resulting from behaviors other than speeding had a lower likelihood of resulting in a fatality than speeding crashes. As speeding was chosen as the reference category it can be said that speeding crashes were significantly more likely to result in fatality than those caused by other behaviors. While the two listed crash types are fairly self-explanatory in the increased likelihood of fatality occurring, the other factors will be discussed below.

Given gender and speed have already been discussed, little more needs to be discussed. It is worth noting that the increased likelihood of males causing fatal crashes is consistent with the literature about speeding and risk-taking (Fuller et al. 2008; Rhodes and Pivik 2011; Richards et

al. 2010; Yannis et al. 2007). However, as multiple logistic regression models take other covariates into account, it is clear that the increased likelihood of fatalities is not solely related to other analyzed factors. With specific regards to speed, it is also a well-known factor for increasing injury severity (Garvill et al. 2003).

Both night time and early morning crashes were at a significantly higher risk of fatality. There is ample international evidence suggesting that night time driving is more risky for young drivers (Chen et al. 2000; Preusser et al. 1998; Rice et al. 2003). Specific risks associated with nocturnal driving include alcohol or psychotropic medications (Helland et al. 2013; Verster et al. 2011) and sleepiness or disturbance of sleep-wake cycles (Mohamed et al. 2012). Neither of these explanatory factors is currently well measured by the ROP. While the ROP does examine alcohol rates, they do not examine drug use among drivers. Fatigue is also difficult to assess. The use of a single crash cause in the data may mean that these factors are masked by other crash causes (e.g. crashes caused by speeding and alcohol use). Whilst it is important to recognize that a significant proportion of both at fault and fatal crashes occur during the day, it is clear that nocturnal driving presents additional risk. This is consistent with findings from the US which indicated a selective increase in serious, but not minor, crash risk at night (Williams 2003). Graduated driver licensing systems are a common approach to reducing road crashes in young drivers (Tefft et al. 2012; Vanlaar et al. 2009; Williams 2007; Williams and Shults 2010). Many such systems include restrictions on nocturnal driving and passengers, which have been shown to significantly reduce fatalities (Fell et al. 2011; Lin and Fearn 2003).

STUDY LIMITATIONS

It is important to recognize a number of limitations in the current study. In order to conduct accurate assessment of the magnitude of road traffic crashes, it is necessary to access reliable data. It is worth reiterating that the road traffic crash database in Oman relies on manual police reporting procedures and is, therefore, vulnerable to human error in the attribution of factors. However, as the crash investigation has legal implications, it is likely that every care is used when handling the data, and only subjective matters, such as the precise cause of crash, are likely to be subject to error. Moreover, the data only pertains to serious crashes. Finally, it is also possible that individuals may not report crashes in order to avoid blame. Thus, it is unclear whether certain profiles of crashes may be more significantly under-reported, and whether this failure to report crashes disproportionately affects specific sub-groups within the population.

RECOMMENDATIONS AND CONCLUSION

Overall, young people were over-represented in injuries and fatalities within the sample time period. While many young people in crashes were driving at the time, it was also evident that young people were often a victim in a crash caused by someone else. Thus, to reduce the impact of road crashes on young people, there is a need to generally address road safety within Oman. The high number of young passengers injured in crashes within Oman may also be reflective of the current seatbelt legislation, which only requires seatbelt use in front seats. One important step to improving young person safety within Oman may be to legislate seatbelt use for all passengers.

When young drivers were involved in crashes they were predominantly male and Omani. There is a clear need for targeted education for males. As has been seen in the international literature, the types of crashes these drivers have can be broadly attributed to risk taking and inexperience.

Particularly, speeding was the main cause of crashes and fatalities. Additionally, nocturnal driving was seen to present an increased risk of fatality. One possible intervention to reduce risk taking behavior and limit nocturnal driving would be the introduction of a graduated driver licensing system with night time driving restrictions. Further, introducing young driver passenger restrictions may further reduce the number of young passengers injured or killed each year.

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Table 1. Characteristics of young (17-25 years) vs. other (<17 or >25 years) people involved in crashes in Oman, 2009-2011.

Variable	*People involved in Road Crashes*					
	Total		People <17 and >25 years		People 17-25 years	
	N	(%)	n	(%)	N	(%)
Gender						
Male	*41,849*	(80.7)	27,775	(80.4)	14,074	(81.3)
Female	*10,016*	(19.3)	6,772	(19.6)	3,244	(18.7)
*Nationality**						
Omani	*41,408*	(79.8)	25,359	(73.4)	**16,049**	(92.7)
Non-Omani	*10,457*	(20.2)	**9,188**	(26.6)	1,269	(7.3)
*Injury Severity**						
Fatal injury	*2,829*	(5.4)	**2,034**	(5.9)	795	(4.6)
Non-fatal injury	*31,313*	(60.4)	20,512	(59.4)	**10,801**	(62.4)
No harm	*17,723*	(34.2)	**12,001**	(34.7)	5,722	(33.0)
*Mode of Involvement**						
Driver	*33,172*	(64.0)	22,071	(63.9)	11,101	(64.1)
Pillion/Passenger	*16,089*	(31.0)	10,234	(29.6)	**5,855**	(33.8)
Pedestrian	*2,604*	(5.0)	**2,242**	(6.5)	362	(2.1)
Total	*51,865*	(100%)	34,547	(66.6 [a])	17,318	(33.4[a])

* significant ($p<0.01$) difference between young people (17-25) and the remaining population (<17 & > 25) in crashes; [a] % of all people in crashes; numbers in bold represent figure with adjusted standardized residuals greater than 2.58 ($p<0.01$)

Table 2. Crashes involving young (17-25 years) and older (>25 years) at fault drivers in Oman, 2009-2011.

Variable	Young drivers 'at fault'		Older drivers 'at fault'	
	n	(%)	n	(%)
Gender				
Male	6926	(89.6)	12519	(89.5)
Female	801	(10.4)	1475	(10.5)
Nationality[*]				
Omani	**7316**	(94.7)	10622	(75.9)
Expatriate	411	(5.3)	**3373**	(24.1)
Time of day[*]				
Early morning (1:00-5:59)	2225	(28.8)	**4415**	(31.5)
Morning (6:00-12:59)	2108	(27.3)	3821	(27.3)
Afternoon (13:00-17:59)	**2538**	(32.8)	4232	(30.2)
Night (18:00-00:59)	856	(11.1)	1527	(10.9)
Day of the week				
Week days	5373	(69.5)	9868	(70.5)
Weekend	2354	(30.5)	4127	(29.5)
Weather				
Normal	7514	(97.2)	13651	(97.5)
Abnormal	213	(2.8)	344	(2.5)
Road Type[*]				
Single-carriageway	**5465**	(70.7)	9559	(68.3)
Dual-carriageway	3549	(29.3)	**4436**	(31.7)
Crash Type				
Vehicle collision	3349	(43.3)	6182	(44.2)
Run-over (person or animal)	878	(11.4)	**1969**	(14.1)
Over-turn	1303	(16.9)	2795	(15.7)
Fixed object collision	**1908**	(24.7)	3135	(22.4)
Motorcycle/Bicycle	289	(3.7)	514	(3.7)
Crash Reason[*]				
Speeding	**4122**	(53.4)	6944	(49.7)
Other Behaviors	3250	(42.1)	**6383**	(45.6)
External Factors	347	(4.5)	657	(4.7)
Injury Severity[*]				
Fatal Injury	325	(4.2)	633	(4.5)
Non-Fatal Injury	**3478**	(45.0)	5836	(41.7)
No-Injury	3924	(50.8)	**7526**	(53.8)
Crash Severity[*]				
Fatal Crash	798	(10.3)	1408	(10..1)

	Injury Crash	5245	(67.9)	9288	(66.4)
	No-harm Crash	1683	(21.8)	**3298**	(23.6)
Total		7727	(35.6 [a])	13995	(64.4 [a])

[*] significant ($p<0.01$) difference between young and older 'at fault' drivers and their crashes; [a] % of all at fault drivers; numbers in bold represent figure with adjusted standardized residuals greater than 2.58 ($p<0.01$)

Table 3. Bivariate analysis between driver, environment and crash characteristics and crash severity of at-fault young driver.

		Fatal Crash		Non-Fatal Crash	
		N	(%)	N	(%)
*Gender**					
	Male	**757**	94.9	6169	89.0
	Female	41	5.1	**760**	11.0
Nationality					
	Omani	753	94.4	6563	94.7
	Expatriate	45	5.6	366	5.3
*Time of Day**					
	Morning (6:00-12:59)	181	22.7	**2044**	29.5
	Evening (1:00-5:59)	186	23.3	**1922**	27.7
	Night (6:00-24:59)	**315**	39.5	2223	32.1
	Early Morning (1:00-5:59)	**116**	14.5	740	10.7
*Day of Week**					
	Weekdays	517	64.8	**4856**	70.1
	Weekends	**281**	35.2	2073	29.9
*Weather**					
	Normal	765	95.9	**6749**	97.4
	Abnormal	**33**	4.1	180	2.6
*Road Type**					
	Single-carriageway	536	67.2	**4929**	71.1
	Dual-carriageway	**262**	32.8	2000	28.9
*Crash Type**					
	Vehicle Collision	277	34.7	**3072**	44.3
	Run-Over	**192**	24.1	686	9.9
	Over-Turn	**210**	26.3	1093	15.8
	Fixed Object Collision	75	9.4	**1833**	26.5
	Motorcycle/Bicycle	**44**	5.5	245	3.5
*Crash Reason**					
	Speeding	**497**	62.3	3625	52.4
	Other Behaviors	248	31.1	**3002**	43.4
	Non-Human Factors	**53**	6.6	294	4.2
	Total (7727)	*798*	*10.3*	*6929*	*89.7*

* *significant ($p<0.01$) difference in likelihood of fatality; numbers in bold represent figure with adjusted standardized residuals greater than 2.58 ($p<0.01$)*

Table 4. Logistic model estimation and odds ratios for significant independent variables for crash severity (fatal or not fatal) of young driver at-fault crashes.

	B	SE B	Sig.	Odds Ratio	95% C.I of Exp(B)
Gender					
Male	0.67	0.168	0.000	1.97	(1.42, 2.74)
Female				1.00	
Time of Day					
Morning (6:00-12:59)				1.00	
Evening (1:00-5:59)	0.06	0.111	0.556	1.07	(0.86, 1.33)
Night (6:00-24:59)	0.31	0.100	0.002	1.37	(1.13, 1.67)
Early Morning (1:00-5:59)	0.56	0.131	0.000	1.76	(1.36, 2.27)
Day of Week					
Weekdays				1.00	
Weekends	0.18	0.082	0.022	1.21	(1.03, 1.42)
Weather					
Normal				1.00	
Abnormal	0.33	0.212	0.120	1.39	(0.92, 2.11)
Road Type					
Single-carriageway				1.00	
Dual-carriageway	0.35	0.084	0.000	1.43	(1.21, 1.68)
Crash Type					
Vehicle Collision				1.00	
Run-Over	0.86	0.117	0.000	2.38	(1.89, 2.99)
Over-Turn	0.34	0.118	0.003	1.41	(1.12, 1.78)
Fixed Object Collision	-	0.146	0.000	0.29	(0.22, 0.39)
Motorcycle/Bicycle	0.60	0.180	0.001	1.82	(1.28, 2.59)
Crash Reason					
Speeding				1.00	
Other Behaviors	-	0.100	0.000	0.58	(0.48, 0.71)
Non-Human Factors	0.34	0.176	0.046	1.41	(1.00, 1.99)

